

# Series LP

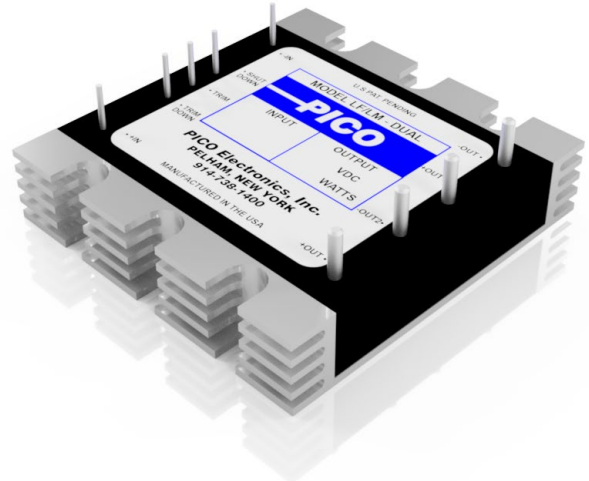
75W Isolated Regulated High Power DC-DC Converter



## PRODUCT OVERVIEW

The LP series are isolated DC-DC converters with a wide selection of input voltage ranges from 18V to 380V in a compact half brick size foot print - 2.4" x 2.3". These modules have trim capability and shutdown features. Protections include input overvoltage, output short-circuit, output overvoltage and over temperature.

The unique case has integrated side heat sink for better thermal dissipation but is capable of conduction cooling through the baseplate or additional top mounted heat sink.



## FEATURES

- 18V to 380V input range models
- 3.3V to 200V output models
- Up to 75W output
- Input/output isolation
- Integrated side heat sink
- Parallel operation option
- Single and dual isolated outputs
- Trim capability
- Remote shutdown feature
- Fixed operating frequency
- No external components required

Contact Pico for part number of available options:

- Select screening per MIL-STD-883:
  - Stabilization Bake
  - Temperature Cycle
  - Burn-In
- Special Input Voltage, Output Voltage, Isolation Voltage or Output Power
- Parallel Operation

LP	A	28	S
SERIES NAME	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE	NUMBER OF OUTPUTS

**LP**

**A** = 18 - 36V

**3.3** = 3.3V

**S** = SINGLE

**B** = 36 - 72V

**5** = 5V

**D** = DUAL

**C** = 100 - 180V

**5.2** = 5.2V

**9** = 9V

**12** = 12V

**15** = 15V

**24** = 24V

**28** = 28V

**48** = 48V

**100** = 100V

**125** = 125V

**150** = 150V

**175** = 175V

**200** = 200V

**225** = 225V

**250** = 250V

**MODEL LIST - LPA (18-36V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPA3.3S	3.3	0.91	9.09	30	73	1	1.5	2
LPA5S	5	1.00	10.00	50	80	1	1.25	1.5
LPA5.2S	5.2	0.96	9.62	50	80	1	1.25	1.5
LPA9S	9	0.67	6.67	60	84	1	1.25	1
LPA12S	12	0.50	5.00	60	85	1	1.25	0.75
LPA15S	15	0.43	4.33	65	85	0.75	1	0.75
LPA24S	24	0.31	3.13	75	87	0.5	0.75	0.75
LPA28S	28	0.27	2.68	75	87	0.5	0.5	0.5
LPA48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LPA100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LPA125S	125	0.04	0.40	50	82	0.3	0.5	0.5
LPA150S	150	0.03	0.33	50	82	0.3	0.5	0.5
LPA175S	175	0.03	0.29	50	82	0.3	0.5	0.5
LPA200S	200	0.03	0.25	50	82	0.3	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPA5D	5	1.00	10.00	25	80	1	1.25	1.5
LPA9D	9	0.67	6.67	30	84	1	1.25	1
LPA12D	12	0.50	5.00	30	85	1	1.25	0.75
LPA15D	15	0.43	4.33	32.5	85	0.75	1	0.75
LPA24D	24	0.31	3.13	37.5	87	0.5	0.75	0.5
LPA28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LPA48D	48	0.16	1.56	37.5	85	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.

Note 4: Dual output loads must be balanced.

**MODEL LIST - LPB (36-72V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPB3.3S	3.3	0.91	9.09	30	74	0.75	1.5	2
LPB5S	5	1.00	10.00	50	80	0.75	1	1.5
LPB5.2S	5.2	0.96	9.62	50	80	0.75	1	1.5
LPB9S	9	0.72	7.22	65	84	0.75	1	1
LPB12S	12	0.63	6.25	75	84	0.5	0.75	1
LPB15S	15	0.50	5.00	75	84	0.5	0.75	1
LPB24S	24	0.31	3.13	75	87	0.5	0.5	0.5
LPB28S	28	0.27	2.68	75	87	0.5	0.5	0.5
LPB48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LPB100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LPB125S	125	0.04	0.40	50	84	0.3	0.5	0.5
LPB150S	150	0.03	0.33	50	84	0.3	0.5	0.5
LPB175S	175	0.03	0.29	50	84	0.3	0.5	0.5
LPB200S	200	0.03	0.25	50	84	0.3	0.5	0.5
LPB225S	225	0.02	0.22	50	84	0.3	0.5	0.5
LPB250S	250	0.02	0.20	50	84	0.3	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPB5D	5	1.00	10.00	25	80	0.75	1	1.5
LPB9D	9	0.72	7.22	30	84	0.75	1	1
LPB12D	12	0.63	6.25	30	84	0.5	0.75	1
LPB15D	15	0.50	5.00	32.5	85	0.5	0.75	1
LPB24D	24	0.31	3.13	37.5	87	0.5	0.5	0.5
LPB28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LPB48D	48	0.16	1.56	37.5	85	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.

Note 4: Dual output loads must be balanced.

**MODEL LIST - LPC (100-180V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPC3.3S	3.3	0.91	9.09	30	74	0.75	1.25	2
LPC5S	5	1.00	10.00	50	81	0.75	1	1.5
LPC5.2S	5.2	0.96	9.62	50	81	0.75	1	1.5
LPC9S	9	0.72	7.22	65	84	0.5	0.75	1
LPC12S	12	0.63	6.25	75	85	0.5	0.75	1
LPC15S	15	0.50	5.00	75	86	0.5	0.75	1
LPC24S	24	0.31	3.13	75	87	0.5	0.5	0.5
LPC28S	28	0.27	2.68	75	87	0.3	0.5	0.5
LPC48S	48	0.16	1.56	75	85	0.3	0.5	0.5
LPC100S	100	0.08	0.75	75	85	0.3	0.5	0.5
LPC125S	125	0.04	0.40	50	85	0.3	0.5	0.5
LPC150S	150	0.03	0.33	50	85	0.3	0.5	0.5
LPC175S	175	0.03	0.29	50	85	0.3	0.5	0.5
LPC200S	200	0.03	0.25	50	85	0.3	0.5	0.5
LPC225S	225	0.02	0.22	50	85	0.3	0.5	0.5
LPC250S	250	0.02	0.20	50	85	0.3	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPC5D	5	1.00	10.00	25	81	0.75	1	1.5
LPC9D	9	0.72	7.22	30	84	0.75	1	1
LPC12D	12	0.63	6.25	30	85	0.5	0.75	1
LPC15D	15	0.50	5.00	32.5	86	0.5	0.75	1
LPC24D	24	0.31	3.13	37.5	87	0.5	0.5	0.5
LPC28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LPC48D	48	0.16	1.56	37.5	85	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.

Note 4: Dual output loads must be balanced.

**MODEL LIST - LPD (200-380V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPD3.3S	3.3	0.91	9.09	30	73	1	1.5	2
LPD5S	5	1.00	10.00	50	80	1	1.25	1.5
LPD5.2S	5.2	0.96	9.62	50	80	1	1.25	1.5
LPD9S	9	0.72	7.22	65	84	0.75	1.25	1
LPD12S	12	0.63	6.25	75	84	0.75	1	1
LPD15S	15	0.50	5.00	75	84	0.75	1	1
LPD24S	24	0.31	3.13	75	85	0.5	0.75	0.5
LPD28S	28	0.27	2.68	75	86	0.5	0.5	0.5
LPD48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LPD100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LPD125S	125	0.04	0.40	50	85	0.3	0.5	0.5
LPD150S	150	0.03	0.33	50	85	0.3	0.5	0.5
LPD175S	175	0.03	0.29	50	85	0.3	0.5	0.5
LPD200S	200	0.03	0.25	50	85	0.3	0.5	0.5
LPD225S	225	0.02	0.22	50	85	0.3	0.5	0.5
LPD250S	250	0.02	0.20	50	85	0.3	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation <sup>(3)</sup> [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
		Min. <sup>(1)</sup> [A]	Max. [A]					
LPD5D	5	1.00	10.00	25	80	1	1.25	1.5
LPD9D	9	0.72	7.22	30	84	0.75	1.25	1
LPD12D	12	0.63	6.25	30	84	0.75	1	1
LPD15D	15	0.50	5.00	32.5	84	0.5	1	1
LPD24D	24	0.31	3.13	37.5	85	0.5	0.75	0.5
LPD28D	28	0.27	2.68	37.5	86	0.5	0.5	0.5
LPD48D	48	0.16	1.56	37.5	85	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.

Note 4: Dual output loads must be balanced.

## SPECIFICATIONS (Nominal $V_{IN}$ , Full Load, $T_A = +25^\circ\text{C}$ , 1 hour warm up unless otherwise specified)

### INPUT

Parameter	Condition	Min.	Typ.	Max.	Units
Input Voltage Range	LPA models	18	28	36	VDC
	LPB models	36	48	72	
	LPC models	100	150	180	
	LPD models	200	300	380	

### OUTPUT

Parameter	Condition	Min.	Typ.	Max.	Units	
Output Ripple	1MHz bandwidth	≤48V output models	-	-	50	mVp-p
		100V output models	-	-	100	
		≥125V output models	-	-	1	%

### ENVIRONMENTAL

Parameter	Condition	Min.	Typ.	Max.	Units
Operating Temperature Range	Baseplate	0	-	+85	°C
Storage Temperature Range		-55	-	+105	°C
Cooling	Conduction through baseplate				

### GENERAL

Parameter	Condition	Min.	Typ.	Max.	Units
Operating Frequency		-	100	-	kHz
Isolation Voltage	Input to output	4242	-	-	VDC
	Input to baseplate	2121	-	-	
	Output to baseplate	1000	-	-	
Insulation Resistance		100	-	-	MΩ
Size	L x W x H	2.4 x 2.3 x 0.5 (60.96 x 58.42 x 12.7)			inches (mm)
Weight	Single output models	-	110	-	grams
	Dual output models	-	135	-	
Case	Aluminum baseplate and Glass Reinforced Polymer				
Potting	Vacuum Impregnated Epoxy				
Tube Packaging (W x H x L)	2.595 x 1.105 x 20 (65.913 x 28.067 x 101.6)				inches (mm)

### PROTECTIONS & FEATURES

Parameter	Condition	Min.	Typ.	Max.	Units
Input Over Voltage	LPA, LPB & LPC models	Yes			
Short circuit or Overload	Hiccup mode, self-recovery	120	-	-	%
Overtemperature	Baseplate, self-recovery	Shutdown	-	95	°C
		Restart	-	50	
Output Overvoltage	Zener diode clamp	-	120	-	%
Shutdown (SHUTDOWN)	Non-latched shutdown, Self-recovery	-	-	0.15	VDC
Output Voltage Trim (TRIM & TRIM DOWN)	Trim up or trim down	-5	0	5	%
Parallel <sup>(3)</sup>	P option models	Connect as shown in connection diagram.			

Note 3: The parallel option allows units to operate the outputs in parallel to share load, increase total power or allow for N+1 redundancy.

## SPECIFICATIONS (Nominal $V_{IN}$ , Full Load, $T_A = +25^\circ\text{C}$ , 1 hour warm up unless otherwise specified)

### DESIGNED TO MEET

Test	Referenced Standard	Description
Vibration	MIL-STD-202	Method 204, Vibration, High Frequency, Condition D
Shock	MIL-STD-202	Method 213, Shock (Specified Pulse), Condition I
Humidity	MIL-STD-202	Method 106, Moisture Resistance
Altitude	MIL-STD-202	Method 105, Barometric Pressure (Reduced), Condition D
Surge	MIL-STD-704	LPA & LPD models

### OPTIONS AVAILABLE - CONTACT PICO FOR PART NUMBER

Parameter	Referenced Standard	Description
Stabilization Bake	MIL-STD-883	Referenced Method 1008 Non-operating maximum storage temperature for 24 hours
Temperature Cycle	MIL-STD-883	Referenced Method 1010 Non-operating at temperature extremes, 15 mins/temp, 10 cycles
Burn-In	MIL-STD-883	Referenced Method 1015 Max operating temperature for 160 hours

### THERMAL RESISTANCE

$$P_{OUT} = \frac{T_C - T_A}{T_{RCA} \times (1/\eta - 1)}$$

$P_{OUT}$  = Output Power in Watts

$\eta$  = Efficiency

$T_C$  = Case temperature in  $^\circ\text{C}$

$T_A$  = Ambient temperature in  $^\circ\text{C}$

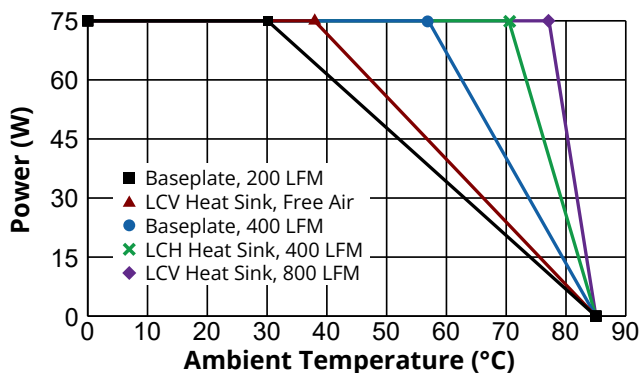
$T_{RCA}$  = Thermal resistance of case to air in  $^\circ\text{C} / \text{W}$

#### Thermal resistance of case ( $T_{RCA}$ )

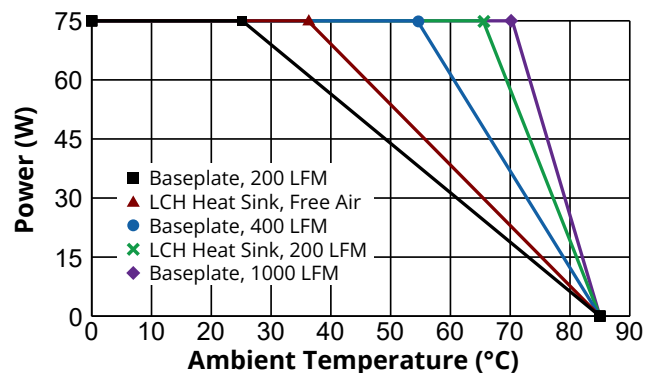
Airflow	Baseplate only	LCV Heat Sink	LCH Heat Sink	Units
Free Air	7.9	4.2	4.0	°C / W
200 LFM	4.9	1.6	1.6	
400 LFM	2.5	1.6	1.3	
600 LFM	2.2	0.9	0.9	
800 LFM	1.5	0.7	0.7	
1000 LFM	1.2	0.6	0.6	

### DERATING GRAPHS (Nominal $V_{IN}$ , Full Load, Efficiency @ Full Load)

Models with Max. Output Power = 75W  
& Efficiency at full load = 87%

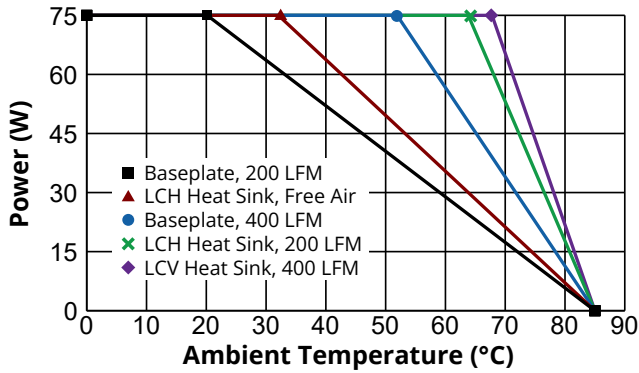


Models with Max. Output Power = 75W  
& Efficiency at full load = 86%

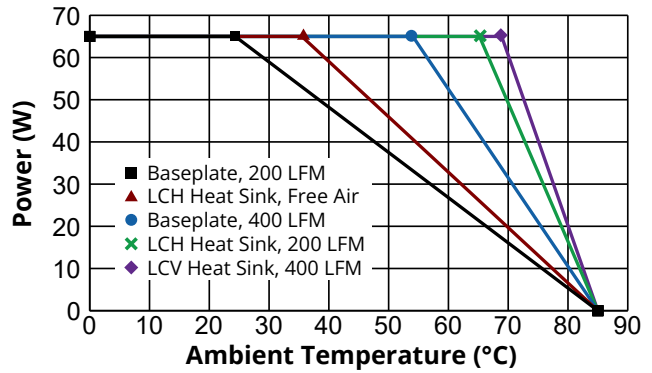


DERATING GRAPHS (Nominal  $V_{IN}$ , Full Load, Efficiency @ Full Load)

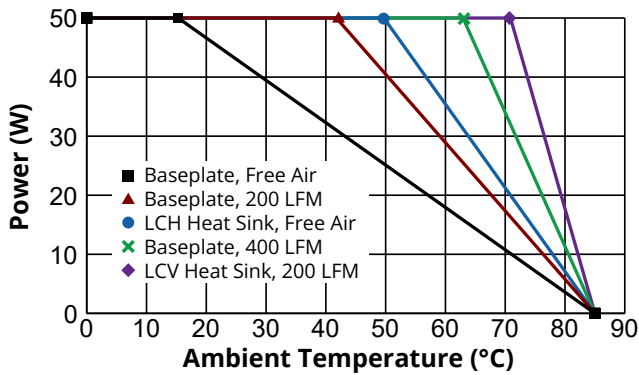
Models with Max. Output Power = 75W & Efficiency at full load = 85%



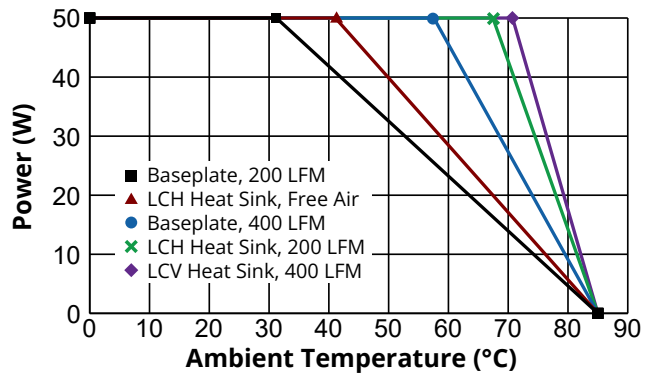
Models with Max. Output Power = 65W & Efficiency at full load = 84%



Models with Max. Output Power = 50W & Efficiency at full load = 85%

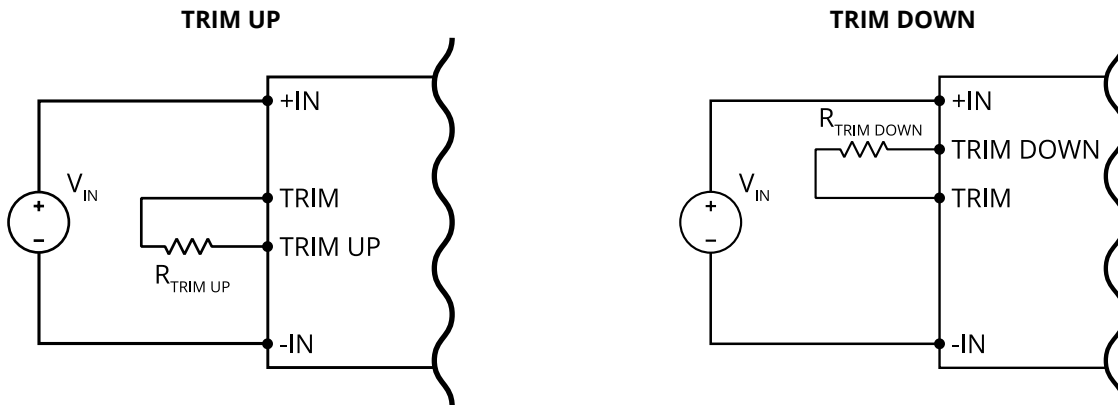


Models with Max. Output Power = 50W & Efficiency at full load = 82%



TYPICAL CONNECTION CIRCUIT

TRIM



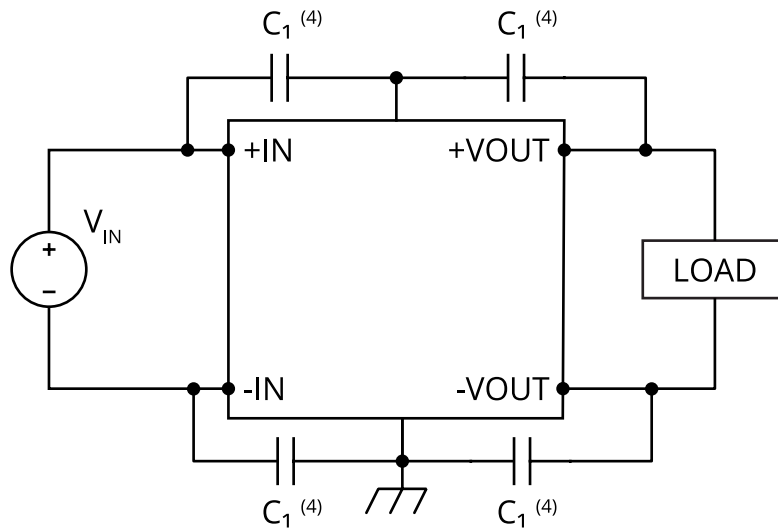
$\Delta V_{OUT}$	0	1	2	3	5	% typ.
Trim Up Resistance	Open	300	150	50	20	k $\Omega$ typ.
Trim Down Resistance	Open	1000	500	250	100	

**Note:** Each individual unit will vary slightly. It is recommended to use a 1M $\Omega$  multi-turn trimmer potentiometer to determine resistance value and achieve desired adjustment. Use minimum 1/2W power rating resistor. Keep the trim resistor leads as short as possible to eliminate the stray inductance which will effect the trimming results.



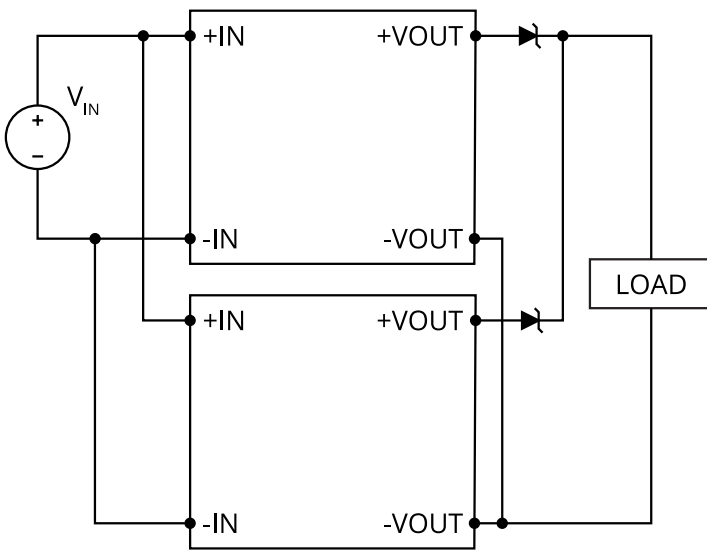
**TYPICAL CONNECTION CIRCUIT**

**NOISE REDUCTION**



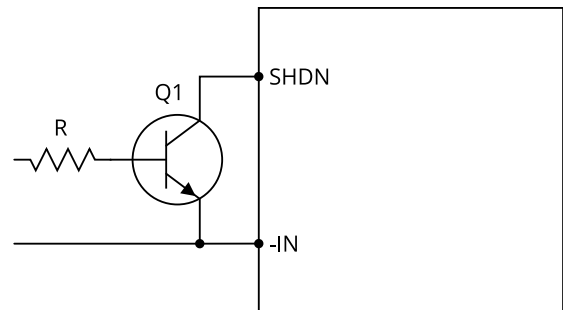
Note 4: C1 filter capacitors may reduce noise further. Please contact Pico for more details.

**PARALLEL**

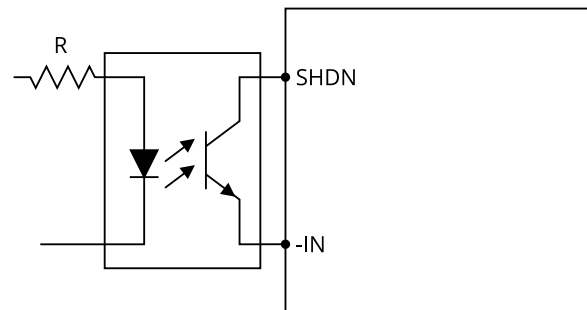


**SHUTDOWN**

**NON-ISOLATED**

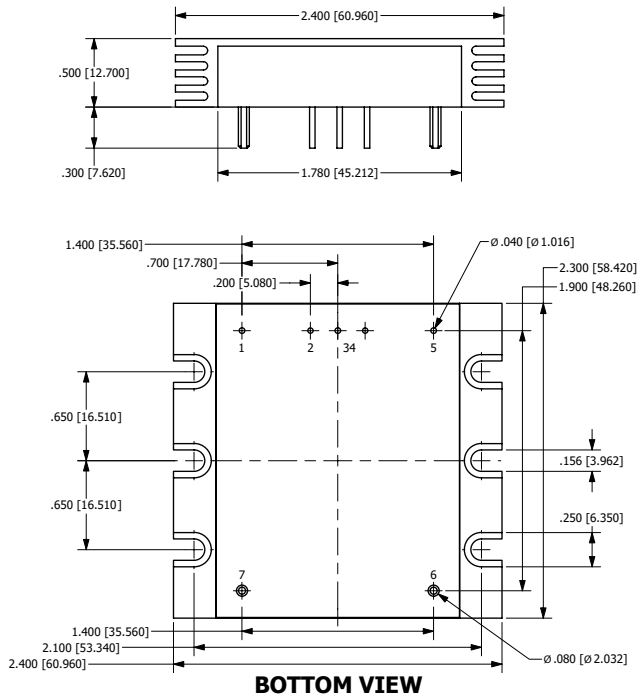


**ISOLATED**



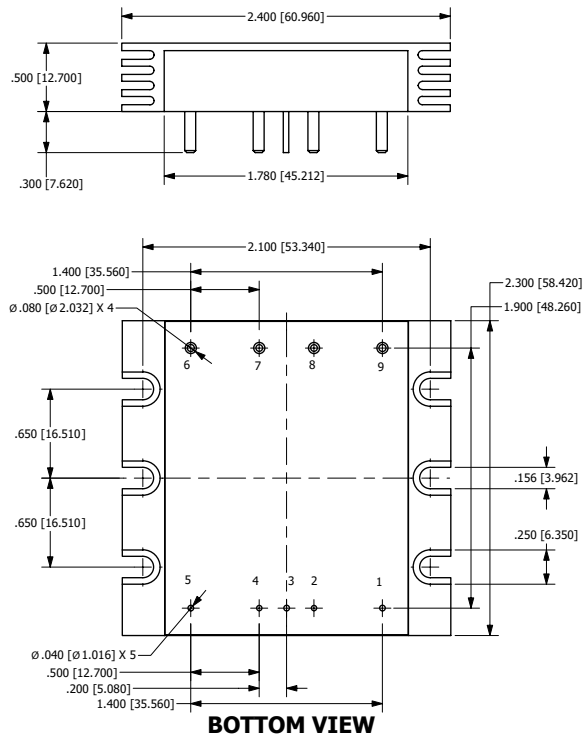
## MECHANICAL DRAWINGS

### SINGLE OUTPUT



PIN	FUNCTION	PIN DIAMETER
1	+IN	.040 [1.016]
2	TRIM DOWN	.040 [1.016]
3	TRIM	.040 [1.016]
4	SHUT DOWN	.040 [1.016]
5	-IN	.040 [1.016]
6	-OUT	.080 [2.032]
7	+OUT	.080 [2.032]

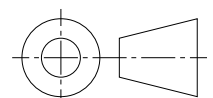
### DUAL OUTPUTS



PIN	FUNCTION	PIN DIAMETER
1	+IN	.040 [1.016]
2	TRIM DOWN	.040 [1.016]
3	TRIM	.040 [1.016]
4	SHUT DOWN	.040 [1.016]
5	-IN	.040 [1.016]
6	-OUT1	.080 [2.032]
7	+OUT2	.080 [2.032]
8	-OUT2	.080 [2.032]
9	+OUT1	.080 [2.032]

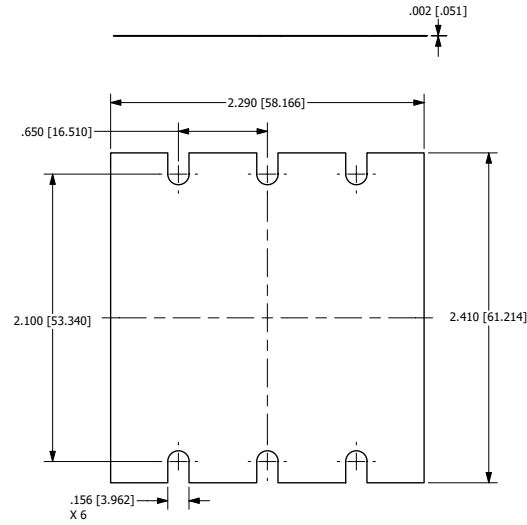
#### NOTES

- ALL DIMENSIONS ARE IN INCHES, [ ] = MM
- RECOMMENDED TORQUE FOR MOUNTING SCREWS: 6-9 INCH-LBS



**MECHANICAL DRAWINGS**

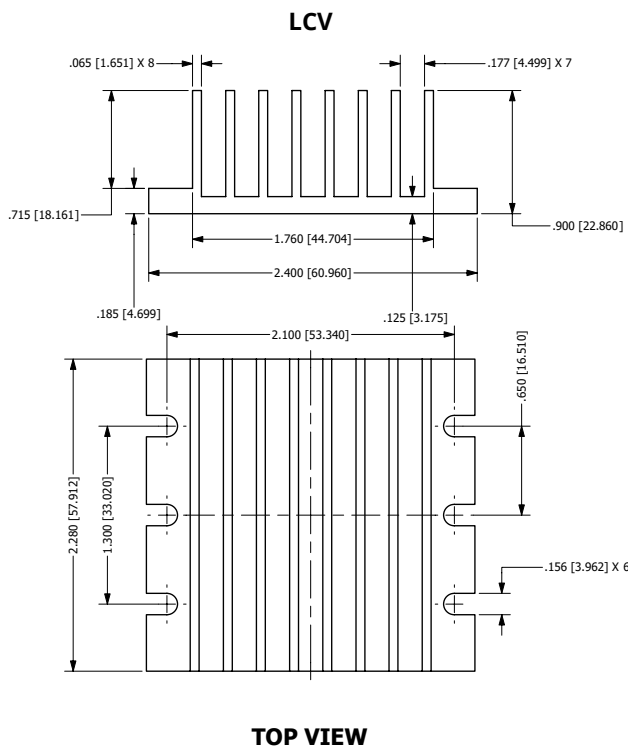
**LTI - THERMAL INTERFACE**



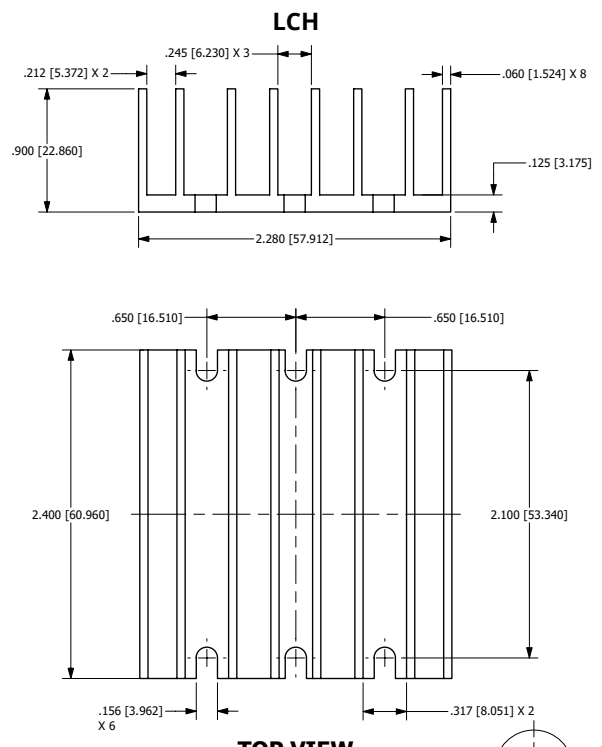
**BOTTOM VIEW**

Material	Alloy Aluminum Substrate
Thermal Conductivity	1530 BTU-in/hr sq.ft °F
Coefficient of Thermal Expansion, (25-100°C)	13.1 10 <sup>-6</sup> in-in/°F
Brinell Hardness	23 HB
Endurance Limit	5000 PSI
Standard Thickness	0.002 inches

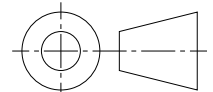
**HEAT SINKS**



**TOP VIEW**



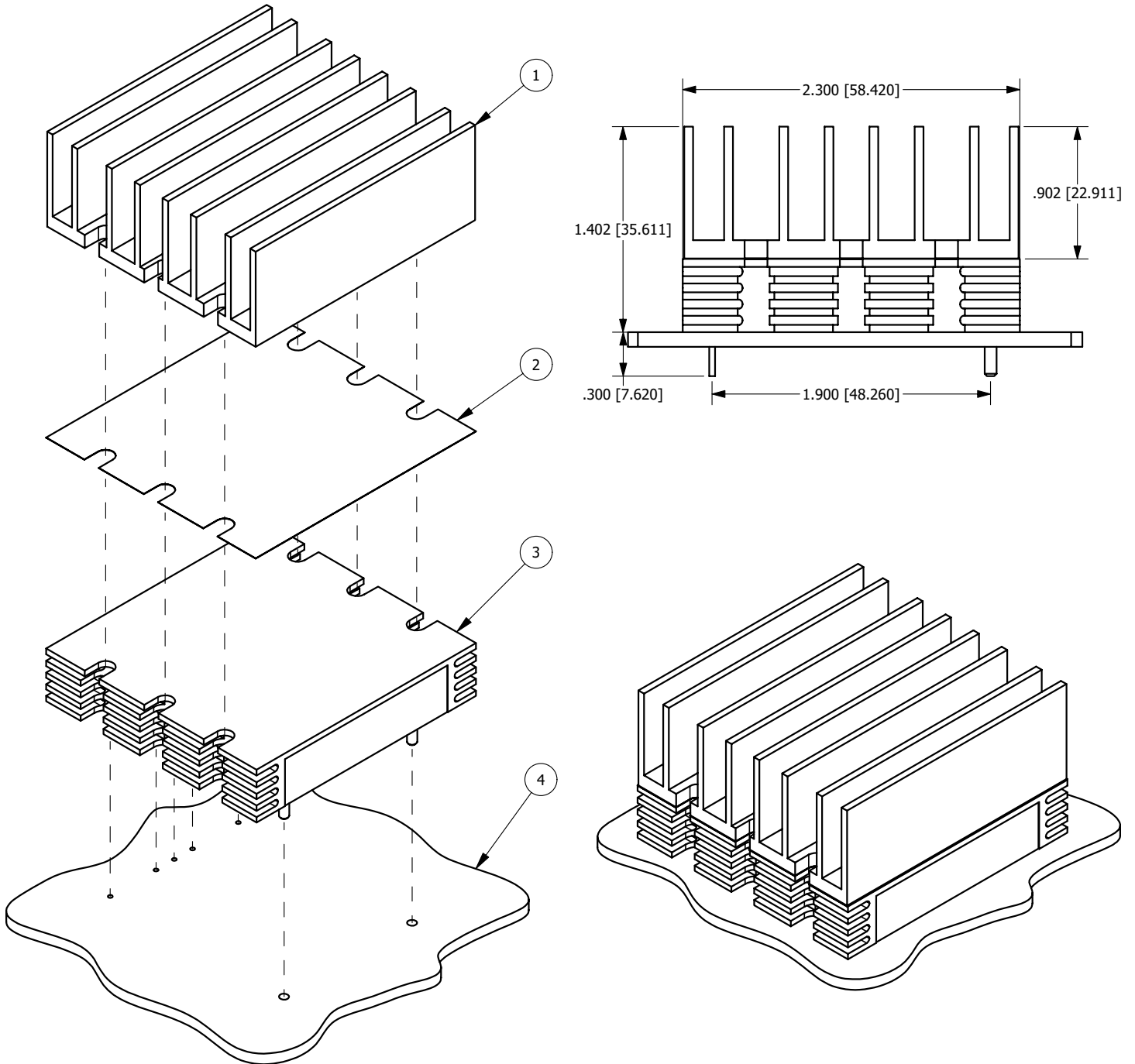
**TOP VIEW**



Weight: 70 grams typical

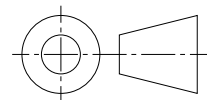
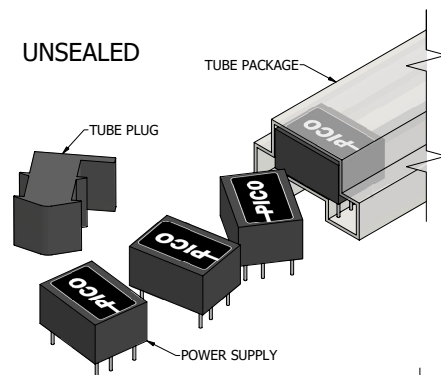
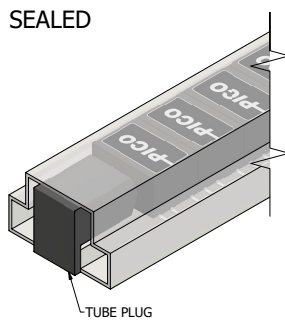
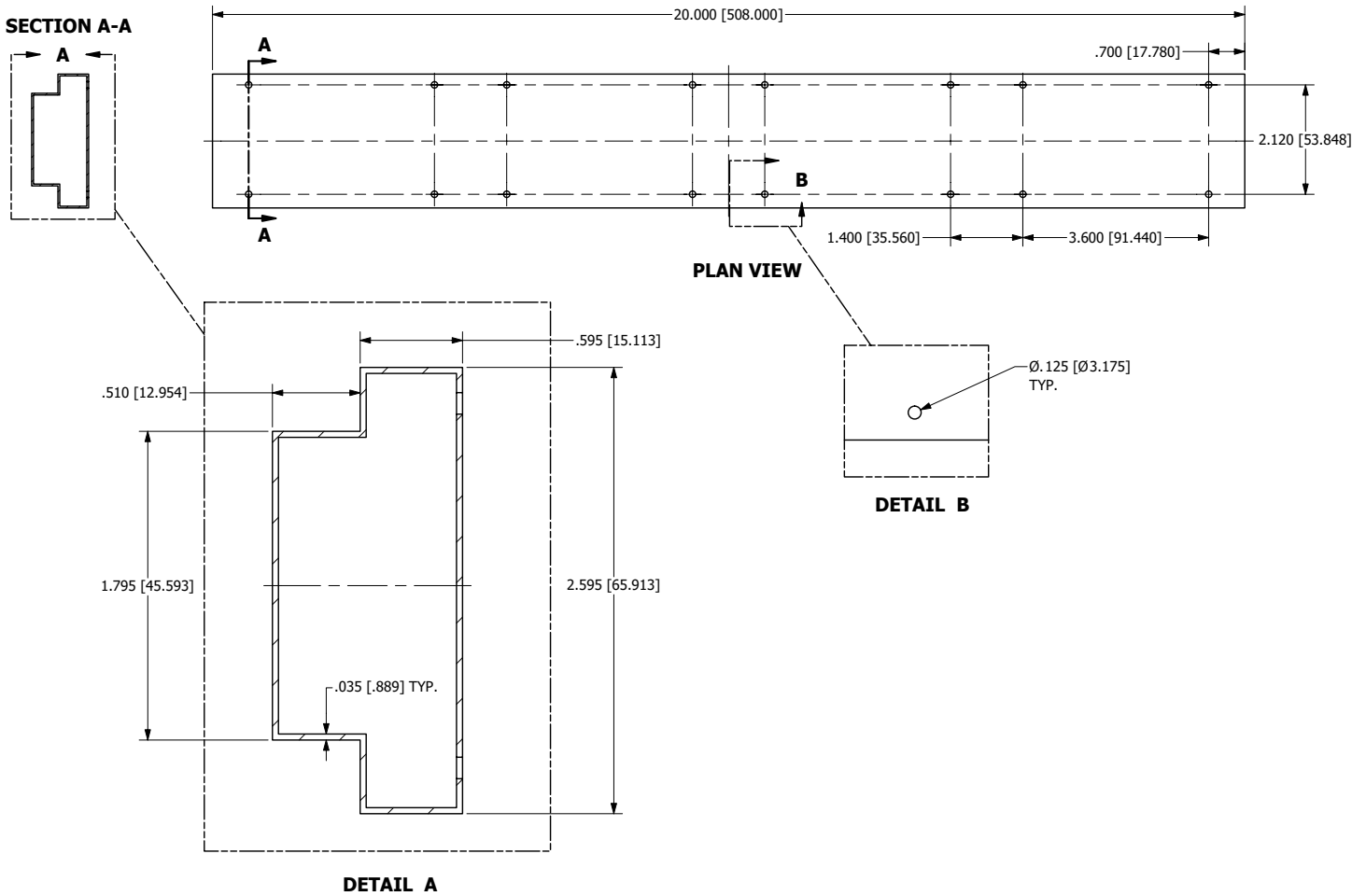
**MECHANICAL DRAWINGS**

**HEAT SINK ASSEMBLY**



ITEM	QTY	DESCRIPTION
1	1	LCH OR LCV HEAT SINK
2	1	LTI THERMAL INTERFACE
3	1	LP MODULE
4	1	PCB

TUBE PACKAGING



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